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Research for People and the Planet

Invited Presentation and Comments to the Delta Stewardship Council

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Thank you for inviting me to present information to the Delta Stewardship Council on the issues of water efficiency and conservation with a focus on California's agricultural sector, along with broader comments on moving to comprehensive solutions to the Bay-Delta (and statewide) water problems. As the Final Interim Plan clearly states:

> "…implementation of the Interim Plan requires full consideration of public input. Opportunities have been and will continue to be provided for the public to engage in the development and implementation of the Interim Plan."

I appreciate this opportunity. Here is a summary of my key conclusions:

1. There is broad agreement that no single strategy in the area of water storage, water efficiency, water pricing, or water policy will be sufficient to satisfy the goals of sustaining the Sacramento-San Joaquin Delta's ecosystems and vital water delivery systems. The proposed policy in the Second Staff Draft identifies mandatory key plan elements, including "water-use efficiency." I support these, with the understanding that they must include both agricultural efficiency improvements and urban improvements, with explicit targets.

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2. The potential for improvements in water-use efficiency, especially in the area of agricultural water use, appears to be consistently underrepresented or misrepresented.[i] "Best available science" in the form of peer-reviewed assessments, general reports, and expert opinion all indicates that this potential is substantial – indeed, the State's most significant water conservation potential lies in this area. Arguments that agricultural efficiency and productivity improvements are unimportant, already achieved, too costly, not worth addressing, or insubstantial are, we believe, easily shown to be false. Part of the problem is serious and serial misunderstandings and misrepresentations of this potential and definitions of efficiency. My more detailed testimony, below, offers two examples of the incorrect arguments by those who argue that agricultural water-use efficiency potential is inconsequential, along with a description of a third "misunderstanding" that leads to an underestimate or discounting of this potential.

3. Research by the Pacific Institute, in the field, and at other organizations and research centers, along with clear historical experience in California and around the world all provide evidence that the potential for improving the efficiency of water use in California agriculture is substantial: we conservatively estimate that potential to be on the order of between 4 and 6 million acre-feet per year (around 10 to 15% of current statewide agricultural water use), in several forms.[ii] This estimate is similar to (and even somewhat less than) the estimate prepared by the CalFed Water Use Efficiency Comprehensive Evaluation (2006).[iii]

4. The failure to adequately analyze and include agricultural efficiency as a central element of Delta strategy leads to potentially costly and inappropriate choices, such as fallowing or infrastructure built to the wrong specifications.

5. In conclusion: Efficiency is one of our cheapest, fastest, most environmentally sound options, but I have long argued it must be part of a comprehensive "Plan." Improving water-use efficiency – ***both*** urban and agricultural – is not the only thing that must be done, but it must be a central element, as specified in law and explicitly described in Goal 4 of Appendix E from the Delta Vision Strategic Plan and in Chapter 4 of the Second Staff Draft of the Delta Plan.

1. No single strategy in the area of water storage, water efficiency, water pricing, or water policy will be sufficient to satisfy the goals of sustaining the Sacramento-San Joaquin Delta's ecosystems and vital water delivery systems.

As the Council's Final Interim Plan notes, the California Water Code section 85021 clearly states:

> "The policy of the State of California is to reduce reliance on the Delta in meeting California's future water supply needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency."

In previous comments made by others to the Council, it seems clear that there is broad agreement that no single strategy in the area of water storage, water efficiency, water pricing, or water policy will be sufficient to satisfy the goals of sustaining the Sacramento-San Joaquin Delta's ecosystems and vital water delivery systems. But achieving this goal also cannot be accomplished without addressing agricultural water use.

Again, as clearly noted in the Final Interim Plan, California's Constitution is similarly explicit in specifying that waste of water is to be prevented and conservation to be pursued:

> "It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare. (Article 10, Section 2.)

Finally, as well described in Appendix D of the Final Interim Plan, the Delta Reform Act also includes specific provisions related to water-supply reliability through water use efficiency and sustainable water use (§ 85020(d). This provision – explicitly laid out as "Goal 4" of the Delta Vision Strategic Plan – also requires that water-use efficiency potential in the agricultural as well as the urban sectors be included in a comprehensive Plan.

2. The potential for improvements in water-use efficiency, especially in the area of agricultural water use, are regularly discounted, underestimated, or misrepresented. [iv]

There is broad agreement that the potential for improving the efficiency of water use in agriculture is not zero, but arguments that agricultural efficiency and productivity improvements are unimportant, already achieved, too costly, or not worth addressing, are, we believe, easily shown to be false. Part of the problem is serious and serial misunderstandings and misrepresentations of this potential and definitions of efficiency.

As examples, here are two (of many) incorrect arguments by those who argue that agricultural water-use efficiency potential is inconsequential, along with a description of a third "misunderstanding" that leads to an underestimate or discounting of this potential.

False Argument A. "Any water that can be saved is already being recaptured and reused by someone downstream. Thus 'on-farm efficiency' can be improved, but with no improvement in 'basin' efficiency."

This is false: very simply, not all water that can be saved is being recaptured and reused. In the most obvious example, most erroneous assessments assume that all water used for "evapotranspiration" is beneficial.[v] This is wrong: substantial amounts of water are lost to unproductive evaporation and can be saved by adopting more efficient irrigation methods, regulated deficit irrigation, and better irrigation scheduling.[vi]

False Argument B. Efficiency improvements are not real savings because the water is simply reused by the same user.

This is an important variant of the first error but confuses efficiency and water-use productivity: it acknowledges efficiency savings, but then says the only water worth saving is water that can be transferred to someone else. Yet what's happening is we are growing more food with the same amount of water or improving crop quality – both are real, measurable, quantifiable improvement in agricultural water-use productivity measured as yield per unit water, or income per unit water.

For example, in 1989, California farmers, on average, grew 9.6 tons of tomatoes for every acre-feet of water applied. In 209, they grew 14.5 tons of tomatoes per acre-feet applied. If farmers in 2009 were as inefficient as they were in 1989, they would have needed 50% more water than they actually used – a large and real savings.[vii]

This misunderstanding reflects diverging policy goals: one goal might be to maintain agricultural productivity while using less water in order to reduce pressures on the Delta; another goal might be to maximize agricultural production while using the same amount of water. This is a *policy* choice, but different than saying there is no potential.

In effect, this argument is the same as saying that we could take all California cropland now in drip irrigation and put it into flood irrigation and it wouldn't increase water demand and use or reduce agricultural production.

Misunderstanding C. Improving agricultural water use efficiency is not worth pursuing if someone downstream is already using the recovered excess runoff.

Ironically, this argument acknowledges the potential for efficiency improvements but then discounts it by misrepresenting its value. Improving the efficiency of this water use has very serious (but poorly quantified) advantages:

i. Water that does not have to be applied can be left instream longer, which provides instream flow and ecosystem benefits.

ii. Water that does not have to be applied does not have to be pumped and distributed, saving water, energy, and greenhouse gas emissions.

iii. Water that does not have to be applied does not pick up contaminants from pesticides, fertilizers, and other agricultural chemicals, leading to water-quality improvements.

Thus, saving "water" is just one of many co-benefit from agricultural water-use efficiency improvements. An important part of the challenge in the Delta is not just addressing water quantity, but quality, and agricultural water-use efficiency improvements can help address these problems as well.

3. The potential for improving the efficiency of water use in California agriculture is substantial.

This conclusion is supported by research by the Pacific Institute, in the field, and at other organizations and research centers, along with clear historical experience. We conservatively estimate that potential to be on the order of between 4 and 6 million acre-feet per year (around 10 to 15% of current statewide agricultural water use). [viii] This estimate is similar to (and even somewhat less than) the estimate prepared by the CalFed Water Use Efficiency Comprehensive Evaluation (2006). [ix] They concluded the technical potential, including recoverable, non-recoverable, and regulated deficit irrigation savings at 6.3 MAF/year.

These savings come from a wide range of well-understood approaches and are based on actual experience from field work with innovative California farmers. The Pacific Institute's analyses have focused on three particular strategies that are already being implemented by innovative farmers in California: [x]

Regulated deficit irrigation: This proven technique involves simply withholding the application of irrigation water to certain crops, in certain climates, during specific periods, without adversely affecting productivity or quality. The potential of this approach to reduce applied water has been estimated at between 0.9 and 1.2 MAF per year. We note this is a real reduction in overall demand (or "new" water, in the terminology of some).

Improved irrigation scheduling: Through a combination of improved soil-moisture monitoring and measurement and greater flexibility in the scheduling of irrigation water deliveries, substantial amounts of water do not have to be applied. This is a reduction in consumptive use, saving real water that can be reallocated to other Delta or State needs. The potential of this approach has been estimated at 3.4 MAF.

Improved irrigation technology: California has made progress over the past two decades in shifting from flood irrigation techniques to a more efficient mix of sprinkler and precision drip systems. This has led to a substantial increase in total agricultural productivity in the form of higher yields and improved crop quality, while either keeping water use constant or decreasing demand – both are efficiency improvements. When normalized for crop productivity, this is a reduction in water use per unit crop or per dollar of income produced. Yet substantial areas of the Sacramento and San Joaquin Valley crop land are still using inefficient irrigation technologies and we estimate additional improvements could save around 1 million acre-feet per year.

4. The failure to adequately analyze and include efficiency potential restricts the policy options available to the Council and risks leading to inappropriate, costly, and unnecessary policy choices, such as:

Fallowing: Fallowing certainly reduces water use but the Institute does not consider fallowing an "efficiency" approach and we do not argue for it in our studies. But failing to consider agricultural efficiency forces some to fall back on fallowing as the only way to reduce agricultural water use. Hanak et al. (2011) for example, effectively discounts water-efficiency improvements in agriculture, which leads them to argue (for example, in Box 2.1, and on page 263) that the only real way to save water in agriculture is "fallowing."

Infrastructure built to the wrong size or needs: The amount of water that is available to be delivered to the Delta from upstream watersheds, and the amount of water that must be delivered south of the Delta both depend on assumptions about efficiency of water use, among other things. Without an assessment of this potential, assumptions about the size, location, and operation of a Delta Bypass will be at best incomplete and at worst completely wrong.

5. In conclusion: Efficiency is one of our cheapest, fastest, most environmentally sound options, but it must be a central element of a comprehensive "Plan."

Improving water-use efficiency – **both urban and agricultural** – is not the only thing that must be done, but it must be a central element, as specified in law and explicitly described in Goal 4 of Appendix E from the Delta Vision Strategic Plan and in Chapter 4 of the Second Staff Draft of the Delta Plan. Every Pacific Institute assessment makes it clear that multiple options must be pursued, but not all options are equal. The significant potential for agricultural efficiency improvements requires that such improvements be a central element of a sustainable Delta Plan. Here are additional components I believe are vital:

- Improvements in urban (including residential, commercial, and industrial) water-use efficiency.
- Expanded storage in the form of groundwater storage systems only (with an emphasis on "south-of-Delta" conjunctive use).
- Expanded groundwater monitoring and management. No sustainable water system in California will be possible until groundwater use is monitored and managed. I support the Second Staff Draft Plan call for transparent data collection and sharing, with local management. I also support statewide groundwater regulation and management when regions fail to develop comprehensive monitoring, quality assessment, reporting, and management.
- A public goods charge on all urban and agricultural water uses and adoption of a clear "user pays" policy.
- Expanded use of recycled, reclaimed, and greywater water in both urban and suburban areas.
- Careful assessment and implementation of appropriate desalination, especially south of the Delta. I would be happy, separately, to discuss what constitutes appropriate desalination.

Thank you for the opportunity to provide comments today.

Endnotes

[i] See, for example, the recent PPIC report Managing California's Water (Hanak et al. 2011), which states: *"We look at urban, rather than agricultural, conservation as an explicit policy tool, because most agricultural water use efficiency efforts do not result in net water savings without extensive fallowing" (Box 2.1).* See also, each of the California Water Plans produced by the Department of Water Resources.

[ii] In a variety of forms, including overall reductions in applied water, capture and use (or reallocation) of non-beneficial return flows, reductions in non-beneficial evaporation, and reductions in non-beneficial transpiration.

[iii] CALFED Bay-Delta Program. 2006. Water Use Efficiency: Comprehensive Evaluation, CALFED Bay-Delta Program Water Use Efficiency Element. Public Review Draft. Sacramento, California. April 2006. Available at http://calwater.ca.gov/content/Documents/library/WUE/2006_WUE_Public_Draft.pdf.

[iv] See, for example, the recent PPIC report Managing California's Water (Hanak et al. 2011), which states: *"We look at urban, rather than agricultural, conservation as an explicit policy tool, because most agricultural water use efficiency efforts do not result in net water savings without extensive fallowing" (Box 2.1).* See also, each of the California Water Plans produced by the Department of Water Resources.

[v] See, for example, the technically flawed diagram 2.1 on page 73 of Hanak et al. 2011.

[vi] Some of the earliest work of the Pacific Institute was in clarifying these definitions of efficiency, and the issue of 'basin' versus 'on-farm' efficiency is well understood. But the assumption that California's agricultural 'basins' are at maximum efficiency is based on assumptions without data, and assumptions that are false, including the incorrect assumption that no water is lost to "unproductive evaporation."

[vii] And these savings do not come from changing crop types but from reductions in applied water. This estimate comes from officially reported data from USDA NASS Ag Statistics Historical Data; the USDA NASS Ag Statistics 2009 Crop Year Report; and the USDA Census of Agriculture, FRIS, 1988-2008.

[viii] In a variety of forms, including overall reductions in applied water, capture and use (or reallocation) of non-beneficial return flows, reductions in non-beneficial evaporation, and reductions in non-beneficial transpiration.

[ix] CALFED Bay-Delta Program. 2006. Water Use Efficiency: Comprehensive Evaluation, CALFED Bay-Delta Program Water Use Efficiency Element. Public Review Draft. Sacramento, California. April 2006. Available at http://calwater.ca.gov/content/Documents/library/WUE/2006_WUE_Public_Draft.pdf.

[x] Cooley, H., J. Christian-Smith, P.H. Gleick. 2009. Sustaining California Agriculture in an Uncertain Future. A Report of the Pacific Institute for Studies in Development, Environment, and Security, Oakland, California. July 2009. 81 pp.